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Transverse changes after surgically assisted rapid palatal expansion

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Abstract. The aim of this retrospective study was to investigate the amount of skeletal and dental expansion in patients submitted to surgically assisted rapid palatal expansion (SARPE). The sample consisted of 21 patients (14 female and seven male) with a mean age of 25.4 years (range 17.4–41.8 years). Postero-anterior (PA) cephalograms were taken pre-expansion (T1), immediately after expansion (T2), and at post-expansion retention of 120 days (T3). SARPE promoted significant transverse skeletal changes, which were maintained from T2 to T3. Dentoalveolar expansion and dental tipping were also observed in the region of the first molars and first premolars; however the net effect at the first molars was significantly less than that at the first premolars. No statistically significant effect on the width of the nasal cavity was observed. The findings indicate that peculiarities inherent to dental effects may influence the clinical options for SARPE. Skeletal expansions with SARPE were significant and stable. Dental changes were different between molars and premolars. The transverse changes after SARPE should be observed for future procedures related to the retention and the completion of orthodontic treatment.

Key words: surgically assisted rapid palatal expansion; rapid maxillary expansion; dentoalveolar changes.

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Surgically assisted rapid palatal expansion (SARPE) is widely indicated for the correction of transversal maxillary discrepancies in adults.[1–6] Clinical evidence of the success of SARPE can be found by opening the midpalatal suture and through maxillary expansion. The dental and skeletal effects of SARPE have mostly been described in studies using cephalometric postero-anterior (PA) radiographs,[1,7–11] plaster models,[1,6–9,12,13] and computed tomography (CT).[14–17] Longitudinal studies of SARPE stability have indicated no specific protocol to follow up the bone and dental changes.[1,6,9,12,13,18,19] Nevertheless, it has been observed that changes occur in the inclination of posterior teeth and in the width of the nasal cavity with quite stable maxillary expansion.[1,7,9,11,20,21]

Although the standard PA cephalogram is an effective method for assessing the transverse changes promoted by SARPE,[7–9,20–22] the superimposition of the structures present in the lower face makes it difficult to locate some structures in the middle portion of the face. A few previous studies[1,20,22] have reported using metallic markers as references to improve radiographic images of the teeth and as anchorage for expansion appliances, thus allowing professionals to see in greater detail the dental changes promoted by SARPE. All of these methods were proposed so that the reference points would become radio-opaque in viewing PA cephalograms, enabling an accurate identification of angular and linear measurements.

SARPE is a common procedure in surgical and orthodontic practice; however the transverse skeletal and dental changes that result have not been described adequately in the orthodontic literature.[6,10] Therefore, the objective of

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this longitudinal study was to quantify in detail the transverse skeletal and dental changes occurring immediately after SARPE and after post-expansion retention of 120 days in adult patients.

Materials and methods

Twenty-one patients (14 female and seven male) with a mean age of 25.4 years (range 17.4–41.8 years) were enrolled in a prospective study. The research project was approved by the institutional research ethics committee.

The inclusion criteria for SARPE were the presence of a posterior bilateral crossbite with skeletal involvement, no periodontal biotype compromise, and no previous orthodontic expansion. Hyrax-type 7-mm screw expansion appliances (Dental Morelli Ltda, Sorocaba, São Paulo, Brazil) were applied with cement in all of the patients. Standard Edgewise orthodontic accessories were welded to the first molar and first premolar bands. Preformed markers made of stainless steel rectangular wire (0.53×0.64 mm) were adapted to the slots of the premolar brackets and molar tubes. These markers had different configurations for the left and right sides, as well as for each group of teeth (Fig. 1).

Two surgeons experienced in this surgical technique performed the surgeries. Under local anaesthetic, a Le Fort I subtotal osteotomy was performed buccally from the maxillary tuberosity to the pyriform aperture.[23] During surgery, the screws were activated 1 mm. A latency period of 7 days was observed, and then the patients were instructed to activate the screws by 0.25 mm twice per day.

PA cephalograms were obtained in the pre-expansion period (T1), immediately after expansion (T2), and at an average of 120 days of post-expansion retention following SARPE (T3), in the same X-ray unit. At these three different times, PA radiographs were taken with the markers positioned in the respective slots of the tubes welded to the bands of the cemented expanders. At the end of each X-ray session, the markers were removed and stored in containers labelled with the name of the patient and the side of the mouth (right/left).

All PA radiographs were digitized at a scale of 1:1. The images were then imported into Radiocef Studio 2 software (Radio Memory, Belo Horizonte, Minas Gerais, Brazil) and computerized cephalometric tracings were performed. Maxillary dental and skeletal changes were identified by means of linear and angular cephalometric measures (Figs. 2 and 3).

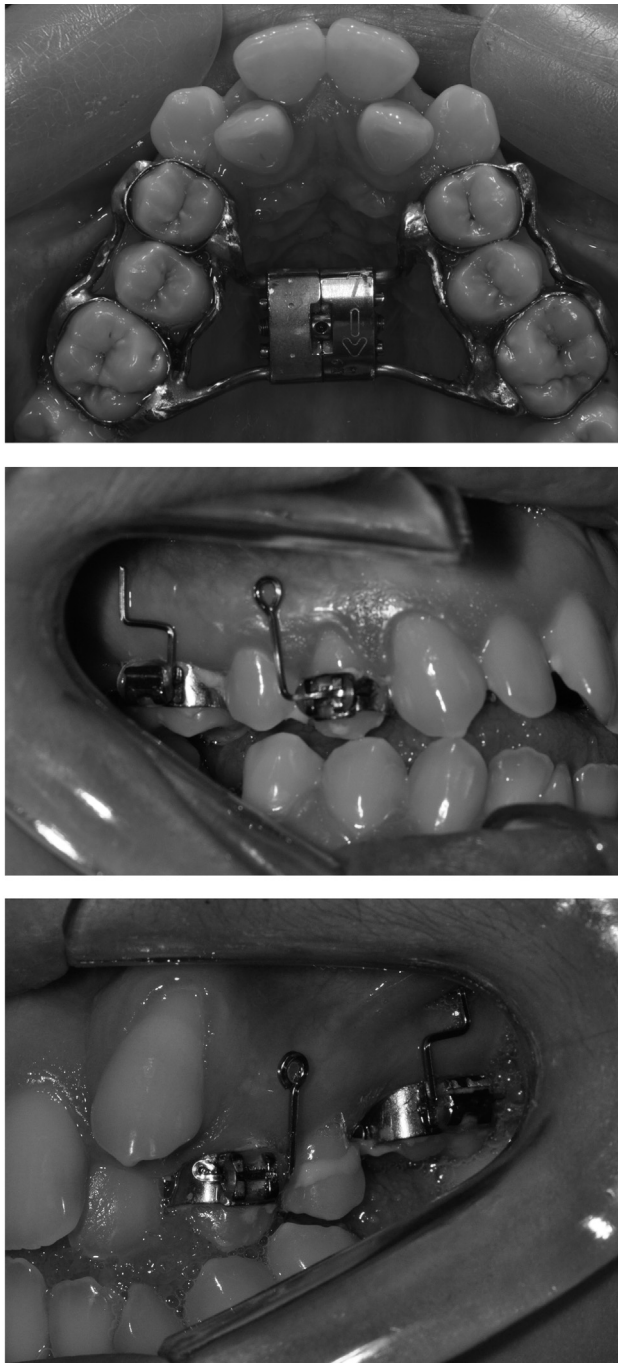

Fig. 1. Hyrax-type expander and markers with different designs for the left and right sides and for each premolar and molar.

All measurements were performed by the same operator (CMT). To determine the error of the method, 15 radiographs were selected randomly and were digitized and traced once again by the same operator after a 60-day interval. A paired *t*-test and Dahlberg's[24] formula were applied to determine systematic and random errors, respectively.

The Shapiro–Wilk test was carried out to verify the normality of the distribution of data. Analysis of variance (ANOVA) for repeated data was performed at a 5% significance level ($P < 0.05$). When ANOVA showed a statistically significant difference, Bonferroni's post hoc test for comparison between groups was applied.

Results

All of the measurements were considered reliable. However, measurements taken